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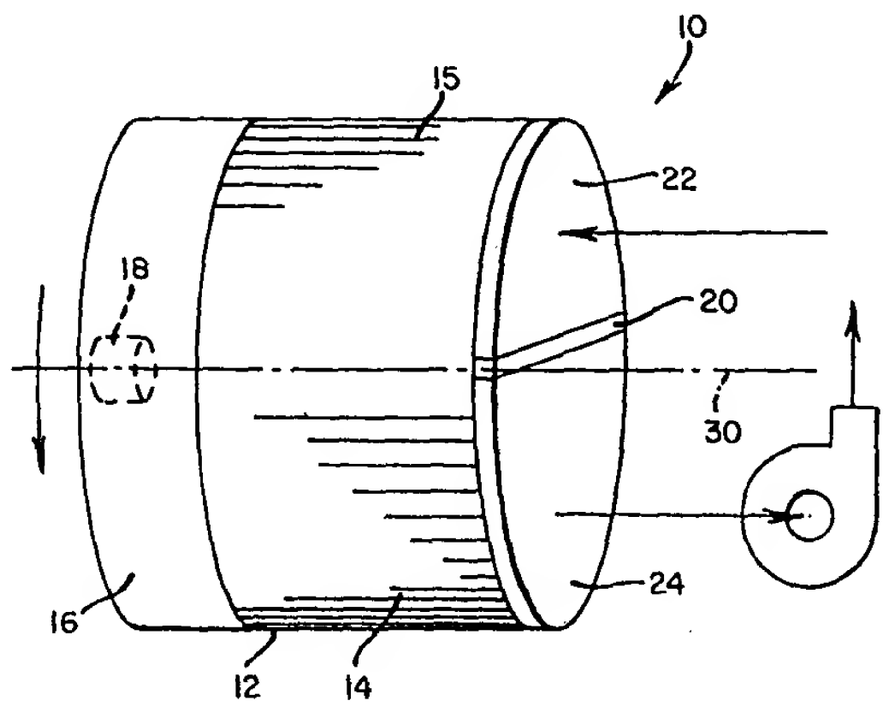
(54) Title: ROTARY REGENERATIVE OXIDIZER



(57) Abstract

A system for the abatement of industrial process gases utilizes a rotary regenerative oxidizer (10) comprised of one or more heat exchange beds (14), each bed comprised of a parallel, axial, and longitudinal array of heat regenerative channels that thermally and/or catalytically oxidize contaminated gases. Utilizing a rotary regenerative oxidizer, and if desired, a plurality of heat regenerative beds incorporated therein, facilitates the use of regenerative technology at lower gas flow rates, increases thermal efficiency and significantly reduces the floor space normally required when implementing fixed–bed nonrotary regenerative oxidizers. The heat exchange channels may be catalytically treated to enhance oxidation of the pollutants at a lower temperature.

WE CLAIM:

1. A rotary regenerative abatement system, for removal of contaminants from process gases, comprising:

one or more rotors, wherein a first rotor comprises a plurality of discrete heat exchange surfaces arranged in an axially parallel and longitudinal array, said rotor having a first and a second end, wherein said surfaces form a plurality of heat exchange channels;

a transfer chamber connected to the second end of said rotor;

a sealing endplate adjoining the first end of said rotor, wherein said endplate divides said rotor into inlet and outlet compartments; and

an adjustable means for rotating said rotor about a longitudinal axis.

2. The abatement system of Claim 1 further comprising a means for purging unreacted process gases from said first rotor.

3. The abatement system of Claim 1 wherein said transfer chamber comprises a heat generating means for heating said process gases to a predetermined abatement temperature.

4. The abatement system of Claim 1 wherein said surfaces are catalytically coated.

5. The abatement system of Claim 3 wherein said surfaces are catalytically coated.

6. The abatement system of Claim 1 wherein said first rotor has a cell density of at least 25 cells per square inch.

7. The abatement system of Claim 6 further comprising:

a stationary second rotor, positioned between said first rotor and said transfer chamber, wherein said second rotor comprises a plurality of heat exchange surfaces arranged in an axially parallel and longitudinal array, said surfaces forming a plurality of heat exchange channels in fluid communication with said first rotor and said transfer chamber, said second rotor having a cell density greater than that of said first rotor.

8. The abatement system of Claim 7 further comprising an adjustable means for rotating said second rotor about a longitudinal axis.

9. The abatement system of Claim 7 further comprising a means for purging unreacted process gases from said second rotor.

10. The abatement system of Claim 7 wherein the surfaces of said second rotor are catalytically coated.

11. A rotary regenerative abatement system, for removal of contaminants from process gases comprising:

a first heat exchange bed comprising a plurality of heat exchange surfaces, arranged in an axially parallel and longitudinal array, each of said surfaces having a first and a second end, wherein said surfaces form a plurality of heat exchange channels;

a transfer chamber communicating with the second end of said surfaces;

a sealing endplate adjoining the first end of said surfaces, wherein said endplate divides said channels into inlet and outlet zones;

a distribution plenum, fluidly communicating with said heat exchange surfaces;

a gas inlet plenum, fluidly communicating with said distribution plenum;

a gas outlet plenum, fluidly communicating with said distribution plenum; and

a one-piece, rotatable flow distributor, wherein said distributor fluidly communicates with said distribution, inlet, and outlet plenums.

12. The abatement system of Claim 11 wherein said sealing endplate further divides said heat exchange channels into a purge zone, and said system further comprises:

a gas purge plenum fluidly communicating with said flow distributor and with said distribution plenum.

13. The abatement system of Claim 11 wherein said transfer chamber comprises a heat generating means for heating the process gases to a predetermined abatement temperature range.

14. The abatement system of Claim 11 wherein said surfaces are catalytically coated.

15. The abatement system of Claim 13 wherein said surfaces are catalytically coated.

16. The abatement system of Claim 11 wherein said first heat exchange bed has a cell density of at least 25 cells per square inch.

17. The abatement system of Claim 16 further comprising:

a second heat exchange bed, positioned between said first heat exchange bed and said transfer chamber, said second heat exchange bed comprising a plurality of heat exchange surfaces arranged in an axially parallel and longitudinal array, wherein said surfaces form a plurality of heat exchange channels in fluid communication with said first heat exchange bed and said transfer chamber, said second bed having a cell density greater than that of said first heat exchange bed.

18. The abatement system of Claim 17 further comprising a means for purging unreacted process gases from said second bed.

19. The abatement system of Claim 17 wherein the surfaces of said second bed are catalytically coated.

20. A method for removing contaminants from process gases, utilizing a rotary regenerative oxidizer in an abatement process, said method comprising the steps of:

directing contaminated process gases into a first end of a first heat exchange bed of said oxidizer;

forcing the process gases into a first end of a plurality of axially parallel and longitudinal heat regenerative channels located within said first bed, for substantial oxidation of the gases therein;

conducting the gases from the first bed, through a transfer chamber adjoining a second end of the channels; and

exhausting the process gases from the transfer chamber, through the channels, to the first end of said first bed, to heat said channels.

21. The method of Claim 21 further comprising a purge step of purging any unreacted process gases prior to the exhaust step.

22. The method of Claim 21 wherein said transfer

chamber comprises a heat generating means for heating the process gases to a predetermined abatement temperature range.

23. The method of Claim 21 wherein said channels are coated with catalyst, said method further comprising the step of catalytically reacting the gases as they pass through the system.

24. The method of Claim 21, wherein said first heat exchange bed comprises a cell density of at least 25 cells per square inch, and said abatement system further comprises a second heat exchange bed comprising a second plurality of axially parallel and longitudinally disposed heat regenerative channels, said second bed positioned between said first bed and said transfer chamber and having a cell density greater than said first bed, wherein said method, subsequent to forcing the incoming gases into the first bed and prior to exhausting the gases, further comprises the step of:

forcing the process gases through the second bed and through said transfer chamber, thence back through the second heat exchange bed and into the first bed.

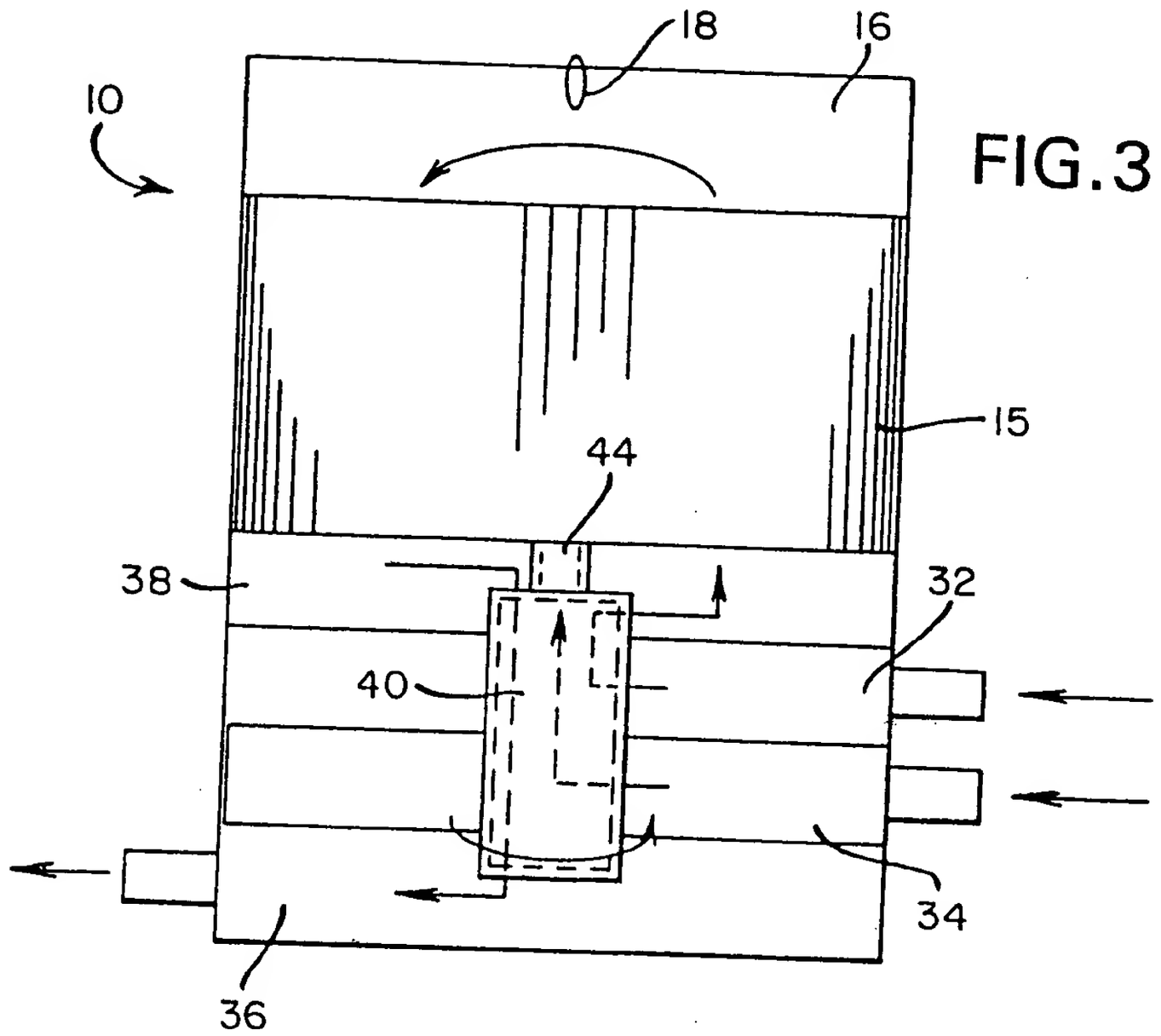


FIG.3

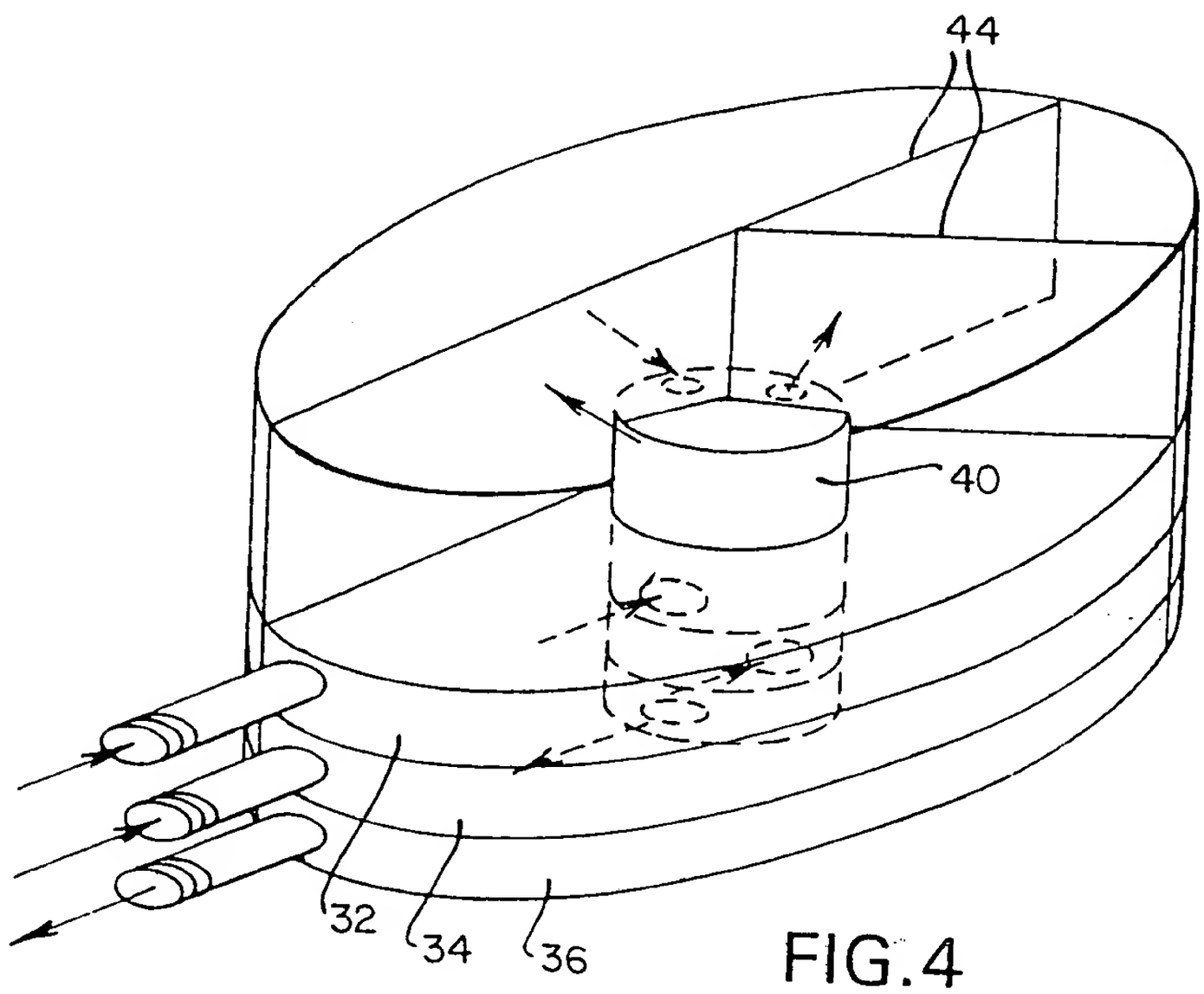


FIG.4